MINISTERIE VAN LANDBOUW

BESTUUR VOOR LANDBOUWKUNDIG ONDERZOEK

KOMMISSIE VOOR TOEGEPAST WETENSCHAPPELIJK ONDERZOEK
IN DE ZEEVISSERIJ (T.W.O.Z.)

(Voorzitter : F. LIEVENS, Directeur-Generaal)

OPTIMAL UTILIZATION AND QUALITY CONTROL OF PICKED DOGFISH (Squalus acanthias L.) USED IN THE HOT SMOKING PROCESS.

D. DECLERCK

Werkgroep " Visverwerkende Bedrijven - Voorverpakking Vis " (I.W.O.N.L.)

Mededelingen van het Rijksstation voor Zeevisserij (C.L.O. Gent).
Publicatie nr 126 - VB/VV (I.W.O.N.L.) 20, 1977

Paper presented at the Seventh Meeting of W.E.F.T.A.,
Dublin, September 1976.

MINISTERIE VAN LANDBOUW

BESTUUR VOOR LANDBOUWKUNDIG ONDERZOEK

KOMMISSIE VOOR TOEGEPAST WETENSCHAPPELIJK ONDERZOEK
IN DE ZEEVISSERIJ (T.W.O.Z.)

(Voorzitter : F. LIEVENS, Directeur-Generaal)

OPTIMAL UTILIZATION AND QUALITY CONTROL OF PICKED DOGFISH (Squalus acanthias L.) USED IN THE HOT SMOKING PROCESS.

D. DECLERCK

Werkgroep " Visverwerkende Bedrijven - Voorverpakking Vis " (I.W.O.N.L.)

Mededelingen van het Rijksstation voor Zeevisserij (C.L.O. Gent).
Publicatie nr 126 - VB/VV (I.W.O.N.L.) 20, 1977

Paper presented at the Seventh Meeting of W.E.F.T.A.,
Dublin, September 1976.

D/1977/0889/2

Summary.

The optimal utilization and quality aspects of picked dogfish (Squalus acanthias L.) were studied.

From 100 kg of fresh dogfish 28,6 kg smoked whole dogfish and 4.9 kg smoked belly flaps were obtained.

The initial quality of the belly flaps before processing was not so good as the quality of the whole dogfish. They had a shelf life of only 12 days. For whole dogfish on the contrary, this was 16 days. The keeping time was limited in this case by the presence of moulds.

In general it can be said that the optimal smoking programme assures a good shelf life, but the high number of Staphylococci suggests that more attention should be paid to the hygienic treatment after the hot smoking process.

1. Introduction.

Smoked dogfish is a popular product on the Belgian market. It is sold traditionally without belly flaps which are discarded.

In Germany and Scandinavian countries these belly flaps are smoked separately (e.g. "Schiller Locken").

Investigations were carried out to evaluate the possibilities of processing these belly flaps in Belgian smoking plants with sufficient consumer acceptance. This paper gives the results of experiments conducted with smoked dogfish belly flaps presented as smoked rolls which appeared to be a very tasty product. Special attention was also given to the problems related to storage time of the product.

2. Materials and methods.

2.1. Technological process.

The picked dogfish (Squalus acanthias L.) were caught during the period January to July 1976 in the Southern part of the North Sea. They were 5 to 7 days old at landing.

After stripping, the belly flaps were cut off and pickled in a 6 % brine for 2 minutes. The rest of the skinned fish was dipped in a 12 % brine for two hours. The whole fish (*) was then desalted for 15 minutes.

Before smoking the belly flaps were rolled up and maintained in this state by pricking a small wooden stick in the fish in the same way as this is carried out in the rolmops manufacture. The "rolls" were put on a rack. The whole fish were hung on smoking trolleys. The product was smoked in a "Torry Kiln" and a hot smoking process was carried out.

Both products were smoked for 45 minutes at 45 and 55° C respectively. Afterwards the temperature was increased to 80° C. The whole process took 165 minutes.

The smoked fish was stored in a cold store maintained at 2° C.

The experiments were repeated three times.

(*) "whole fish" : this term applies for skinned headless dogfish without belly flaps.

1.2. Methods.

- Fat content : by the method of Bligh and Dyer (1).
- Dry matter and salt content : by the methods of the AOAC (2).
- Total volatile bases (TVN) : by the method of Lücke and Geidel (3) as modified by Antonacopoulos (4).
- Thiobarbituric acid (TBA) : determined by the method of Tarladgis et al. (5), but using Antonacopoulos' still (6).
- Ammonia : by accelerated microdiffusion (7).
- Microbiological assessments : - total bacterial counts at 20°C and 37°C.
  - the total numbers of Enterobacteriaceae, Staphylococci, Coli, faecal Streptococci, yeasts and moulds by the methods discribed by Mossel and Tamminga (8).
  - the differentiation of gram negative rods according of Shewan's scheme (9).

3. Results and discussion.

3.1. Technological results.

The internal temperature of the fish at the end of the smoking process was 67° C in the belly flaps and 61° C in the whole dogfish.

Table 1 - Dry matter, fat and salt contents of the fresh and smoked product.

Dogfish	Fat %	Salt %	Dry matter %
Whole fish			
Fresh	5.7	0.5	23.7
Smoked	6.5	0.7	27.8
Belly flaps			
Fresh	14.7	0.7	32.5
Smoked	18.5	1.0	38.8

Table 2 - Loss in weight after stripping and smoking of three batches of dogfish (kg).

Initial weight	Stripped			Smoked	
	Whole fish	Belly flaps	Belly flaps (skin removed)	Whole fish	Belly flaps
100	33, 9	8	5. 1	17. 9	4. 1
100	34. 7	10. 2	7. 2	28. 6	5. 5
100	35. 5	10	7. 1	29. 2	5. 3
Average	34. 7	9. 4	6. 4	28. 6	4. 9

The weight losses from the belly flaps and the whole fish due to the steaming process were respectively 23. 1 % and 17. 6 %.

3. 2. Organoleptical assessment.

Organoleptical judgment showed that shelf life of the smoked whole dogfish was limited by the appearance of moulds after 17 days of storage. On the other hand smoked belly flaps had to be rejected after 14 days of storage. They then became sticky and earthy.

3. 3. Chemical results.

Table 3 shows the chemical results of smoked dogfish products during storage at 2° C. The analyses were interrupted after 21 days. The initial quality of the fresh belly flaps was not so good as those of the bodies. Directly after the smoking process a decraese of TVN, NH_3 and TBA was noted. Afterwards TVN and ammonia regularly increased and showed in both cases (belly flaps and whole fish) the same spoilage pattern. TMA determinations did not give good results and must be rejected as quality test for smoked picked dogfish.

Table 3 - TVN, TBA, NH_3 and TMA-contents of fresh and smoked whole dogfish and belly flaps.

Storage in days	Whole fish				Belly flaps			
	TVN mg N%	TMA mg N%	NH_3 mg N%	TBA mg	TVN mg N%	TMA mg N%	NH_3 mg N%	TBA mg
Fresh	45.5	0.1	32.3	0.8	58.8	3	41.1	1.6
Smoked	30.8	0.1	17.4	0.6	49	3.6	28	1.2
7 d	39.2	0.5	19.8	1.5	56	3.6	38.5	2.3
14 d	44.8	1.2	28.6	2.9	68.8	3.7	52.8	4.7
17 d	51.8	1	34.2	3.2	77.2	5.4	62.3	6.7
21 d	67.2	1.3	56.1	4.7	94.2	4	78.1	8.9

Changes in the thiobarbituric acid content were small for the smoked whole fish but already important for the smoked belly flaps after 14 days, indicating a more pronounced oxidation.

3. 4. Microbiological results.

Total bacterial counts decreased as a result of the hot smoking process (table 4 and 5). The presence of bacteria just after the hot smoking process is mainly due to recontamination by manual handling and contacts with trolleys, scales and packing materials. For the smoked whole dogfish as well as for the belly flaps, total bacterial counts were in the same range. Between the 14th and the 17th day of storage, a total bacterial count of 10^5/g and a staphylococcal count of 10^2/g were reached.

Coli bacteria and faecal Streptococci could not be counted in the hot smoked products. The examination for Staphylococci was positive and the relative high numbers of these bacteria on the surface of the smoked products indicate a need for more hygienic conditions after processing.

Growth of yeast and moulds was noted after 14 days of storage. This was in good agreement with the organoleptical judgment. Smoked whole dogfish were rejected as a result of mould colonies appearing after 17 days.

Organisms isolated in order of decreasing number consisted of Alcaligenes (Achromobacter), gram-positive cocci, Pseudomonas group III, and Aeromonas.

The genera Vibrio and Flavobacterium were not isolated.

Before and directly after the smoking process a same distribution of types of bacteria was determined on the belly flaps as well as on the whole dogfish.

Table 4 - Total bacterial counts on fresh and hot smoked whole dogfish.

Storage in days at 2°C	Total bacterial counts		Anaerobic bacteria	Yeasts and moulds	Entero-bacteria-ceae	Staphylo-cocci	Coli	Faecal Strepto-cocci
	at 20°C	at 37°C						
Fresh number/g	89.10^4	55.10^3	8.10^3	11.10^1	3.10^1	5.10^3	1.10^1	1.10^1
Smoked								
1 day	42.10^1	25.10^1	3.10^1	-	2.10^1	5.10^1	-	-
7 days	15.10^2	25.10^1	1.10^1	-	1.10^1	6.10^1	-	-
14 days	8.10^4	16.10^3	70.10^1	-	-	6.10^1	-	-
17 days	40.10^4	20.10^3	18.10^3	2.10^1	1.10^1	4.10^2	-	1.10^1
21 days	8.10^5	12.10^4	25.10^4	18.10^2	-	8.10^2	-	-

Table 5 - Total bacterial counts on fresh and hot smoked belly flaps of picked dogfish

Storage in days at 2°C	Total bacterial counts		Anaerobic bacteria	Yeasts and moulds	Entero-bacteria-ceae	Staphylo-cocci	Coli	Faecal Strepto-cocci
	at 20°C	at 37°C						
Fresh number/g	65.10^5	29.10^3	1.10^1	1.10^1	6.10^2	1.10^3	5.10^2	1.10^1
Smoked								
1 day	70.10^1	6.10^1	$.5.10^1$	-	1.10^1	1.10^1	-	-
7 days	78.10^1	4.10^1	2.10^1	-	-	1.10^1	-	-
14 days	19.10^3	98.10^2	3.10^2	4.10^1	1.10^1	8.10^1	-	-
17 days	13.10^4	25.10^3	90.10^3	1.10^2	-	7.10^2	-	-
21 days	15.10^4	99.10^3	11.10^3	3.10^2	-	3.10^2	-	-

Sixty seven procent of the organisms found on the fresh whole dogfish were gram-negative rods belonging to the genera Alcaligenes (53 %), Pseunomonas group III (13 %) and Aeromonas (1 %).

Directly after the hot smoking process, gram-positive organisms increased (61 %) and the genus Alcaligenes decreased (29 %).

At the end of the storage period the distribution of the types present on the smoked whole dogfish was the following : Alcaligenes (53 %), Pseudomonas (26 %), gram-positive cocci (20 %).

On the other hand gram-positive cocci (59 %) dominated after 21 days of storage for the smoked belly flaps. The gram-negative rods belonged to the genera Alcaligenes (34 M) and Pseudomonas (6 %).

Acknowledgement.

This work is part of the programme of the Commission for Applied Scientific Research in Fisheries and was supported by grants from the "Instituut tot Aanmoediging van het Wetenschappelijk Onderzoek in Nijverheid en Landbouw" (I. W. O. N. L.), Brussels.

Literature.

1. Bligh, E. & Dyer, W. (1959) : Can. J. Biochem. Physiol. 37, 911.
2. Methods of the AOAC (1970) : AOAC, Washington, 11th Ed.
3. Lücke, W. & Geidel (1935) : Zeitschr. Lebensm. -Unters. 70, 441.
4. Antonacopoulos, N. (1968) : Lehrbuch der Lebensmittelchemie, vol. III/2, Springer Verlag, Berlin.
5. Tarladgis, B., Watts, B. 9 Jonnathan, M. (1960) : J. Amer. Oil Chem. Soc. 37, 44.
6. Antonacopoulos, N. (1960) : Zeitschr. Lebensm. -Untersuch. u. Forsch. 113, 113.
7. Vyncke, W. : Fish. News Int. 7, 49 (1968).
8. Mossel, A.A. and Tamminga, S.K. (1973) : Methoden voor het microbiologisch onderzoek van levensmiddelen. P.C. Noordevliet, Zeist.
9. Shewan, J.M., Hodgkiss, W. and Hobbs, G. (1960) : J. Appl. Bact. 23, 379.